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Introduction to the Study of Cell and Molecular Biology

CASE STUDY: Why don't antibiotics cure my cold?

Picture the scene: it's winter, your head aches, your sinuses are clogged, your coughing and sneezing won't stop. Do you go to the Dr. and can the Dr. help you? The common cold plagues so many people every winter, and people just want to be cured. One often hears about people going to the Dr. and asking for antibiotics for their cold, but they will not help. Why?

Colds are caused by a group of viruses known as the rhinovirus family. Viruses are microorganisms that can infect the cells of our body. They are nasty because they are essentially parasites that co-opt our cellular machinery to reproduce themselves. In contrast, bacteria do not cause colds but rather can be the cause of a secondary infection that occurs during or after a cold. Many bacteria normally live in our bodies, but sometimes these bacteria begin to multiply and accumulate causing infection. In addition, our bodies can be infected by bacteria that are contracted from other people or objects and cause infection.

Questions:

1. Penicillin is an antibiotic that acts by inhibiting the formation of peptidoglycan cross-links in the bacterial cell wall. Based on your knowledge of the structure of bacteria and viruses, will penicillin effectively kill the rhinovirus? Why or why not?

Answer: Bacteria have cell walls, but neither the rhinoviruses that enter our cells nor the cells that they enter have a cell wall. This means that the penicillin will be completely ineffective at stopping the replication of the virus and cannot kill the virus. Thus penicillin will be ineffective in eliminating the cold.

2. People also talk about catching a cold by touching surfaces that have been touched by someone else with a cold, such as the faucet handle of a bathroom sink. Can the cold viruses that are on these surfaces be replicating and reproducing? Why or why not?

Answer: The cold virus cannot replicate or reproduce on surfaces outside the body. This is because the virus needs the machinery of our cells to reproduce itself. The virus can however exist on these surfaces for up to 3 days. This means that you can still contract the virus by touching these surfaces that contain live viruses.

3. After entering cells, most viruses will use the host cell RNA polymerase to transcribe their DNA into RNA, which will get translated into proteins that are needed for virus function. There has been a lot of interest over the past couple of years regarding the use of anti-viral drugs that act to halt the viral replication cycle. Scientists are continually trying to develop new drugs that

target different aspects of the viral life cycle. Do you think it would effective to target a drug to cellular RNA polymerase to halt viral replication? Why or Why not?

Answer: This would be a terrible idea. Viruses replicate by co-opting the host cell machinery to drive their reproduction. While targeting RNA polymerase would halt viral transcription, it would also halt cellular transcription in the host. So while the drug would kill the virus, it would kill the patient too! Scientists therefore focus their efforts on developing drugs against specific virus-specific targets. The problem has been that viruses mutate rapidly so that the viruses can quickly become drug resistant.

Where can I learn more?

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